INSTRUCTION MANUAL

EC-31-CM

NJE CORPORATION

345 CARNEGIE AVENUE, KENILWORTH, N. J.

INSTRUCTION MANUAL

MODEL EC-31-CM DC POWER SUPPLY

NJE CORPORATION
345 CARNEGIE AVENUE
KENILWORTH, N. J.
CHESTNUT 1-1500

SECTION I

SPECIFICATIONS

MODEL
EC-31-CM

INPUT:	120 volts, 60 cycles per second, single phase, at approximately 5 amperes, 85% power factor, at full load.
OUTPUT:	Continuously variable by front panel control from 0 to 40 volts DC at 0 to 10 amperes.
RIPPLE:	1% RMS maximum.
REGULATION:	Line, ±0.5% for line voltage variations of ±10%. (Line regulated units only). Load, 4 % (of maximum output voltage rating) no load to full load.

SECTION 2

THEORY OF OPERATION

2-1. GENERAL.

The information in this section applies in general to all conventional metallic-rectifier type power supplies. Specific circuit details pertaining to this power supply should be obtained, after reading this theoretical treatment, from the circuit diagram at the rear of this manual.

2-2. POWER SUPPLY CIRCUIT.

The elements of a metallic rectifier power supply are as follows: (refer to figure 1).

a. A variable power transformer, whose output voltage is adjustable from zero to approximately 120% of the input voltage value. In three-phase units a separate variable power transformer is used for each phase, and the three rotors are ganged to one control shaft.

b. A transformer-rectifier circuit that steps the input voltage up or down as required to provide the rated range of output voltage, and converts the ac current to pulsating direct current. The rectifier circuit used will depend upon the current range of the unit. It will be a full-wave centertapped configuration in light-current supplies, and a full-wave bridge, three-phase half wave, or six-phase star configuration in heavy-current units.

c. A low-pass, single-section, choke-input filter, designed to suppress the ripple component in the pulsating dc voltage.

d. A heavy-duty bleeder resistor. This bleeder "pre-loads" the metallic rectifier, so that a minimum current is drawn even when the external load is disconnected. At very light loads the rectifier exhibits a greater variation in its internal voltage drop, for a given change in load current, than it does at heavier loads. The bleeder, by imposing an initial load, thus causes the rectifier to be operated in a load region which results in less load regulation by the rectifier. (In cases where the external load is permanently connected to the supply, this bleeder resistor can be disconnected, thereby making an additional amount of current available for use in the load, with no sacrifice in regulation.) In addition to acting as an initial load, the bleeder resistor also assures rapid discharge of the filter capacitors, removing the shock hazard for personnel inspecting or maintaining the equipment after shutdown.

In this "brute-force" type of dc power supply, tight load regulation is achieved through the use of transformers and chokes with low internal resistance,

and heavily-derated rectifiers. The total series resistance is low, and the resultant voltage drop due to the passage of the load current is correspondingly small. The change in load voltage, as the load current is varied from zero to maximum, is consequently a relatively small one. There is no compensation for line voltage changes, however, and a line variation of a given percentage will result in a dc output voltage change of the same percentage. This effect is unimportant in many applications, where line variations would have an adverse effect, the ELS or ELG models are employed. These units are provided with one or more line voltage regulating transformers ahead of the variable power transformer. The output of the regulating transformer varies less than 0.5% for an input variation of 10% and thus provides a very steady AC source for the power supply circuit.

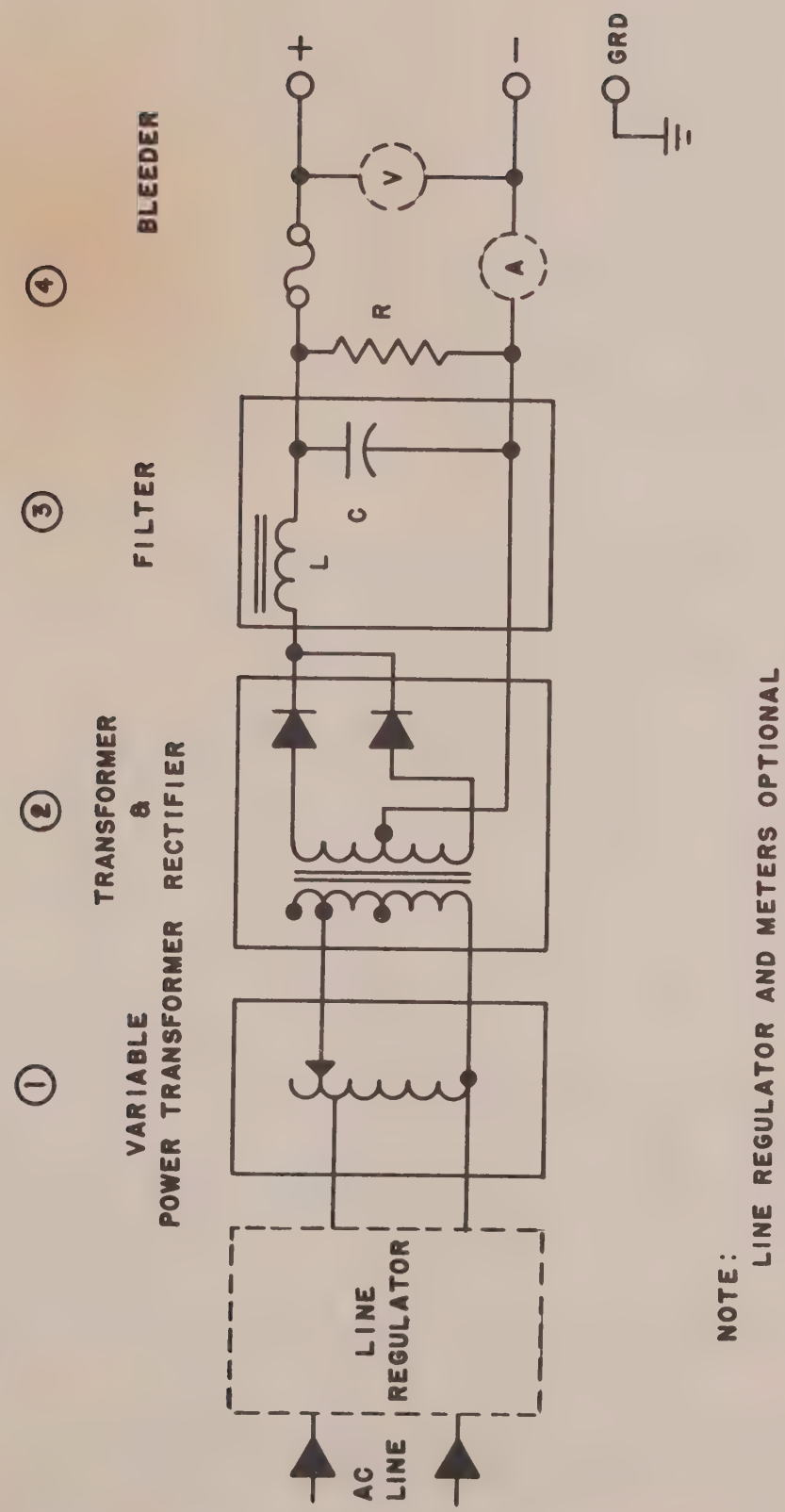

Figure 1. Metallic Rectifier Power Supply

SECTION 3

MAINTENANCE

3-1. GENERAL.

Care should be exercised to prevent the accumulation of dust and dirt in the equipment. An adequate natural flow of clean, fresh air, free of corrosive gases, should be maintained at all times the equipment is in operation. Sudden changes in temperature and humidity should be guarded against. While the equipment will operate over a wide range of physical conditions, every effort should be made to maintain the temperature of the room over zero degrees C and below plus 45 degrees C with a minimum of humidity.

3-2. PREVENTIVE MAINTENANCE.

A well-organized maintenance program will materially aid dependable operation and reduce 'down time' of the equipment to a minimum. A maintenance program, if followed, will often forestall trouble and breakdowns, where the trouble is at once clear, to general overall wear and deterioration of parts over a long period of time. Particularly guard against the latter condition by conducting complete inspections at regular intervals. It is suggested that the equipment be tested shortly after it is put into operation for the first time, and the results be recorded as a reference for comparison with subsequent weekly tests. In addition to voltage measurements, a check of the voltage at the output of the rectifier and at the output terminals should be made with an oscilloscope, or if none is available, an ac voltmeter in series with a dc blocking capacitor.

The following procedure is recommended at intervals of 3 to 6 months:

a. Disconnect power supply from input line.

b. Remove cabinet, covers and/or bottom plate, and inspect the circuitry for dust or dirt deposits (which should be blown or brushed away) and remove foreign objects, such as hardware or small components, which may have fallen in through the ventilating spaces during bench use. Look for signs of overheating, which may indicate overloading due to misuse or malfunctioning of a part.

c. Check that chassis-mounted components are securely held in place by their clamps or brackets. Wipe them with a soft cloth to remove heavy dust deposits.

d. Check knobs, binding posts, terminal strips, and fuse extractor clamps for looseness. Tighten carefully, preserving alignment.

e. Check calibration and zeroing of meters, if used.

f. Check that fuseholders contain the correct valve fuses. Do not overfuse!

g. Replace cabinet, covers and/or bottom plate, and check operation of instrument as outlined in step h.

h. Rough regulation check: Operate supply from a 115 volt line. Set supply to approximately midrange. Monitor output with external meters, unless it has panel meters. A long-scale external voltmeter is recommended, under circumstances, for a meaningful check. This meter should read at least midscale at midrange of the supply, so that changes of the order of the nameplate regulation are discernible. Alternately connect and disconnect an external load of appropriate rating and resistance to draw full load current for the output level selected observing the voltmeter for steady-state* changes. If the output varies more than the product of nameplate regulation and output voltage, a detailed check of the unit should be made.

i. Ripple check: Check output ripple by means of a low-range ac voltmeter coupled to the dc output by means of a 0.1 microfarad capacitor. If excessive, check the capacitor bank for blown fuses or "open" capacitors. Examination of the waveform on oscilloscope at the input terminal of the filter choke should show smooth half-sine-wave patterns for each rectified phase. A notch in the wave-form indicates a defective choke, while absence of any phase indicates a defective rectifier.

*The "recovery-time" of all conventional power supplies is such that they will momentarily deflect several times their stated regulation when full load is suddenly applied. Read the steady-state value as the output. Removing the load does not, in general, cause such transients.

3-3. TROUBLE SHOOTING.

WARNING

ALL NJE POWER SUPPLIES PRODUCE VOLTAGES DANGEROUS TO LIFE! EXERCISE EXTREME CARE IN PERFORMING ANY TEST AND REPAIRS WHEN THE EQUIPMENT IS ENERGIZED.

In general, component failures in NJE Power Supplies will be limited to line and load fuses by the conservative circuit design employed in their manufacture. The following general hints should be of assistance in locating faults:

a. NO OUTPUT VOLTAGE--LOW OUTPUT VOLTAGE.

1. Check fuses, visual check is not enough - use low-range ohmmeter.

2. Check input power line voltage with accurate ac voltmeter.

3. Check output of transformers, rectifiers and filter circuits. If there is no output from a given stage, or if it is significantly low, try replacing the component, first checking for short circuits in the circuit which follows it.

b. POOR REGULATION.

1. Excessive load: Check that load current is within rating of supply.

2. Outside range: Check that load voltage to which supply is set lies within its rating. Often a supply can be adjusted to operate beyond the range for which it was designed, but it will not regulate properly over the entire current range under these conditions.

3. Low line voltage: Check input power line voltage with the supply plugged in and operating using accurate ac voltmeter. Remember that the ordinary multimeter or rectifier-type voltmeter rarely has an original accuracy of better than 3% of full scale, which may imply as much as 10-12 volts of error on the scale used for measurement of 115 volts ac. NJE supplies work effectively down to 105 volts rms, but below that value they may lose their ability to regulate full load currents.

4. High line voltage: Excessively high line voltage can cause component failure in a power supply, as in any other electronic device. Avoid using your power supply in locations having more than 125 volts rms at any time.

c. EXCESSIVE RIPPLE.

1. Verify that one polarity of supply has been connected to, or bypassed to the chassis. A "floating" supply has much more inherent hum and noise than one in which the chassis "ground" is at the same potential as the positive or negative output terminal. Check the load for "activity" by replacing it with a fixed resistor of appropriate value, connected by reasonably short leads. Check that measurement of ripple is valid. Ripple is best measured on calibrated oscilloscope.

2. Check all points discussed under Failure To Regulate above.

3. Check hum out of filter. If it is excessive, check the rectifiers for unbalance, the choke for shorts, and the filter capacitors for opens.

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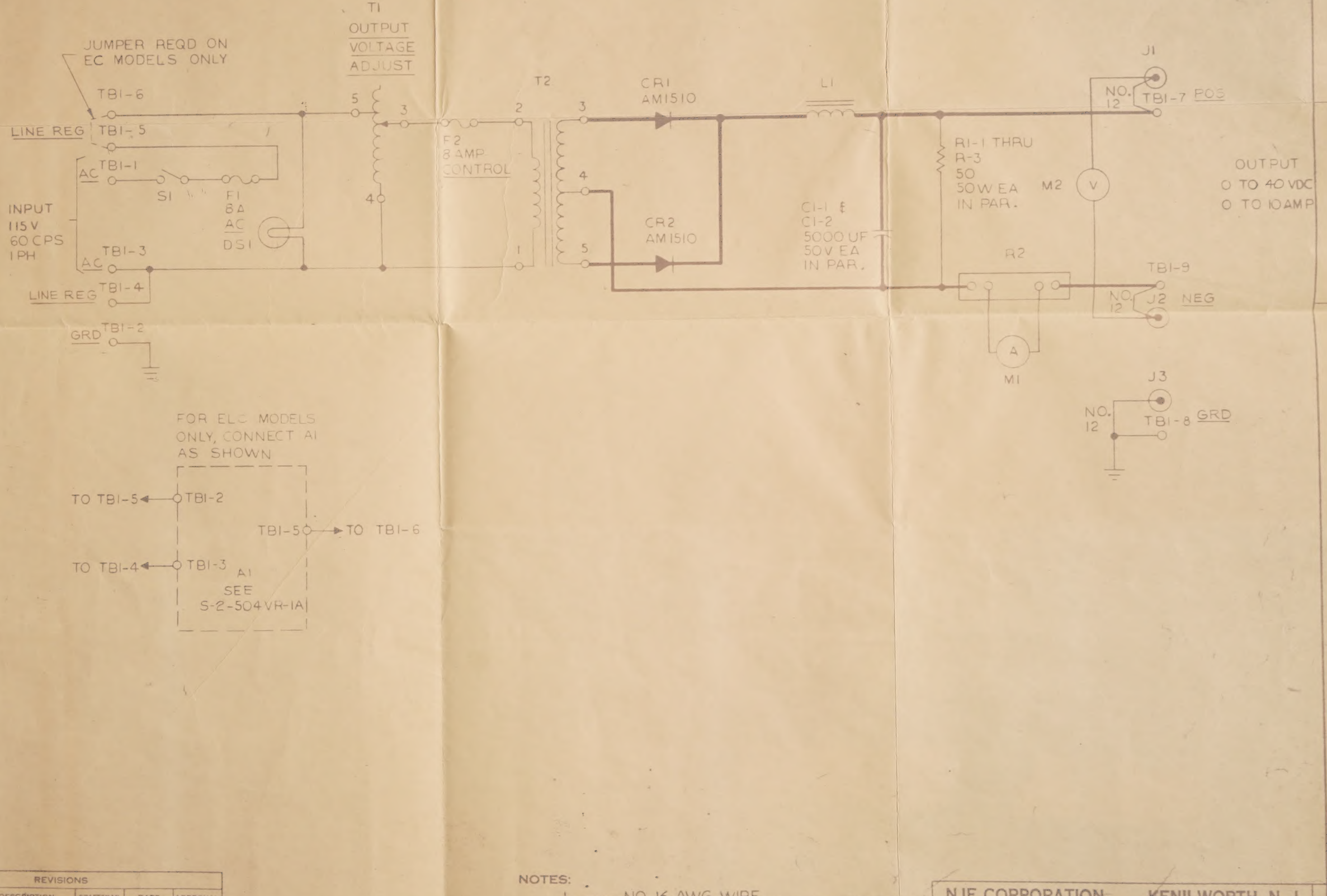

NOTES:

1. —— NO. 16 AWG WIRE
   —— NO. 8 AWG WIRE
   UNLESS OTHERWISE INDICATED.

REVISIONS				
SYM	DESCRIPTION	DRAFTSMAN	DATE	APPROVAL

MICROFILM

NJE CORPORATION KENILWORTH, N. J.			
DRAFTSMAN BG	DATE 7/14/60	TITLE MODEL EC/ELC-31 SCHEMATIC DIAGRAM	SHEET 1 OF 1
DESIGNER			
CHECKED BG	7/14/60		
ENGINEER		DWG NO. S-EC/ELC-31-1C	REV 0
APPROVED			

RECEIVED
OCT 5 1969

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T.I 2

OUR WARRANTY: N J E Corp. warrants each power supply manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to replacing any defective parts thereof, except tubes and fuses in "standard-grade" models. This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and which upon our examination is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.